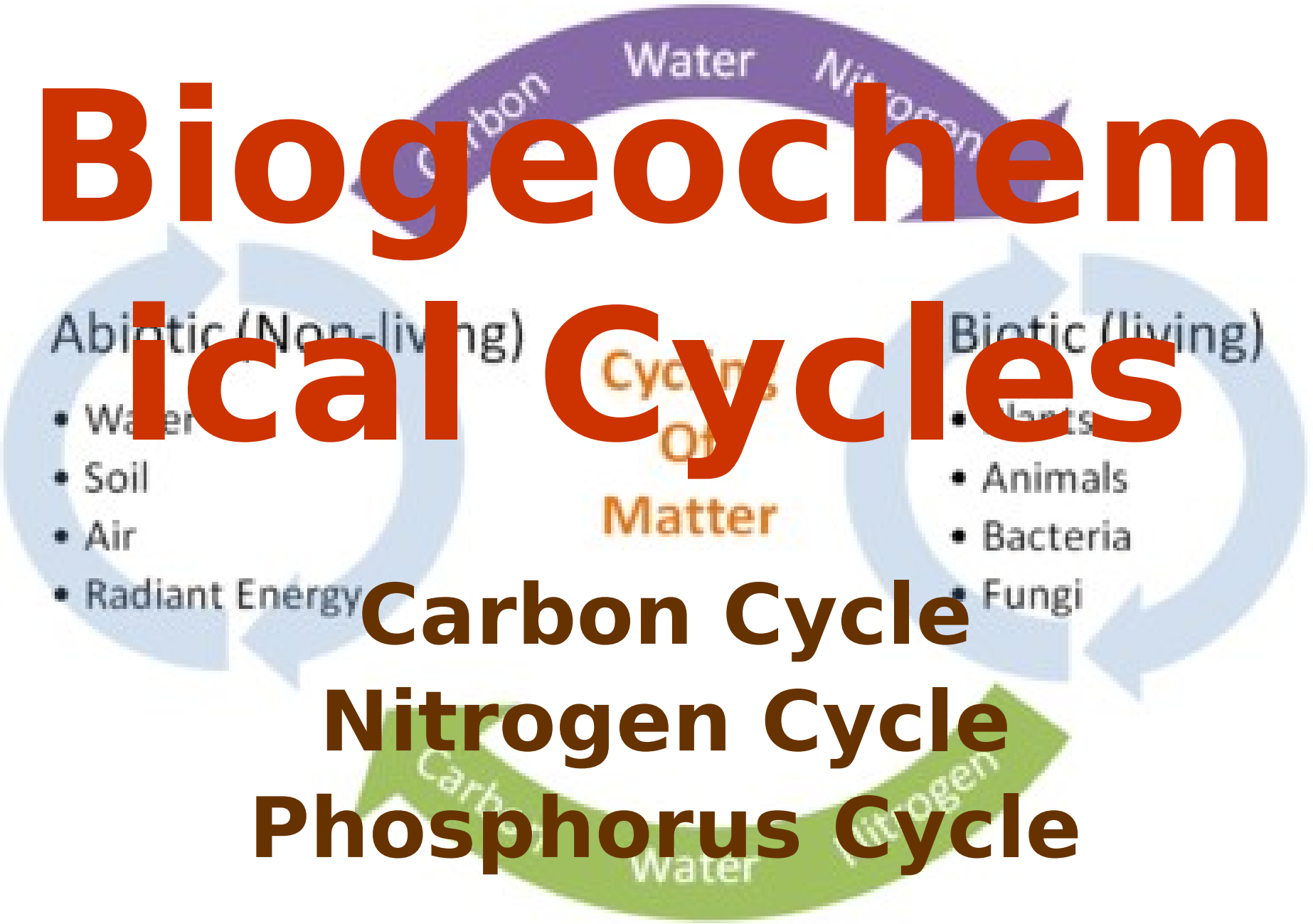
Biogeochemical Cycles



Carbon Cycle
Nitrogen Cycle
Phosphorus Cycle

Matter is recycled within and between **ecosystems**.

Biogeochemical Cycles

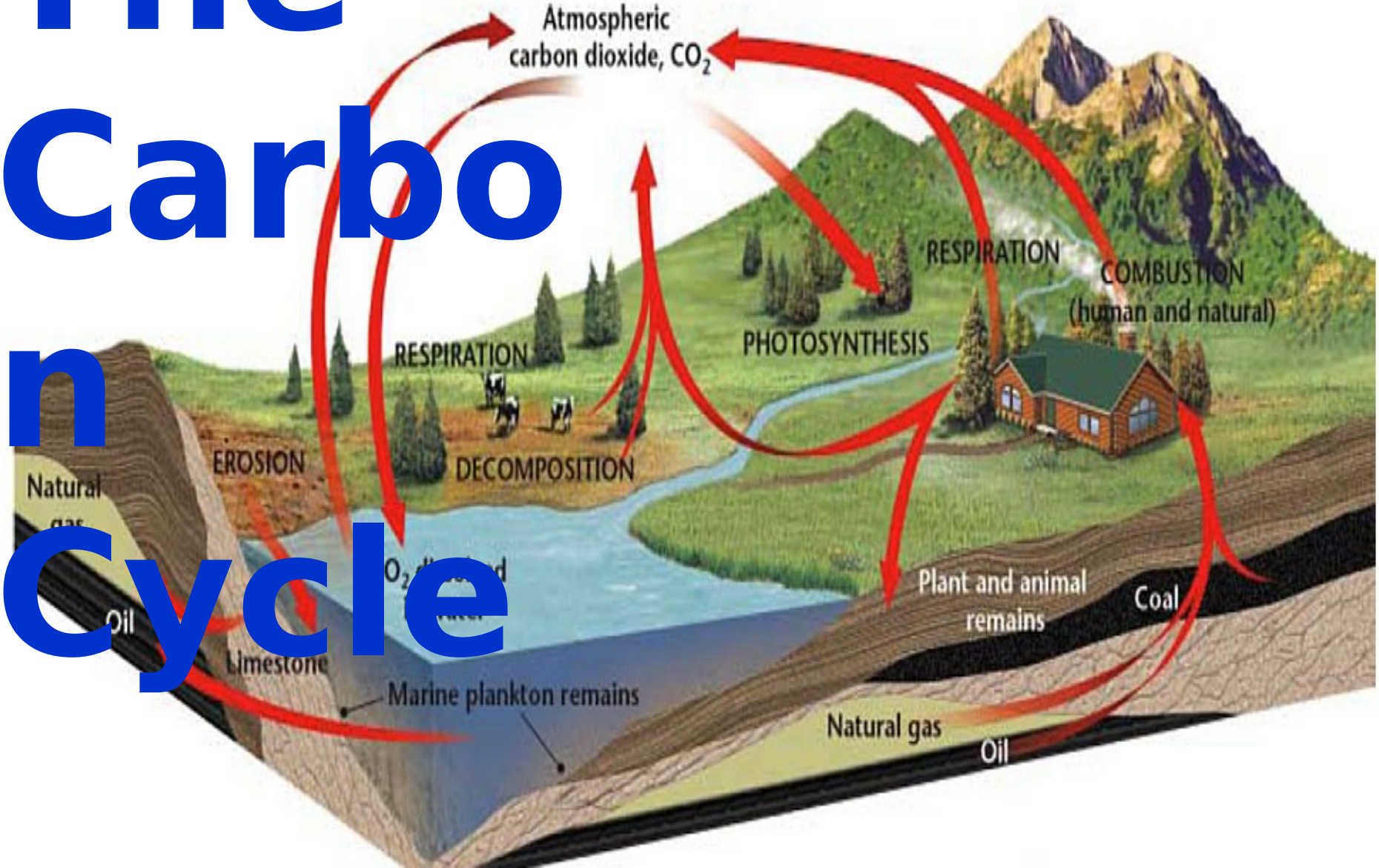
Biogeochemical Cycles

or nutrient cycles, are how **elements**, **chemical compounds**, and other **forms of matter** are passed from one organism to another and from one part of the biosphere to another.

Types of Biogeochemical Cycles:

1. **Hydrologic** - ex water cycle
2. **Atmospheric** - ex carbon cycle and nitrogen cycle
3. **Sedimentary** – ex phosphorus cycle

The Carbon Cycle



The Carbon Cycle

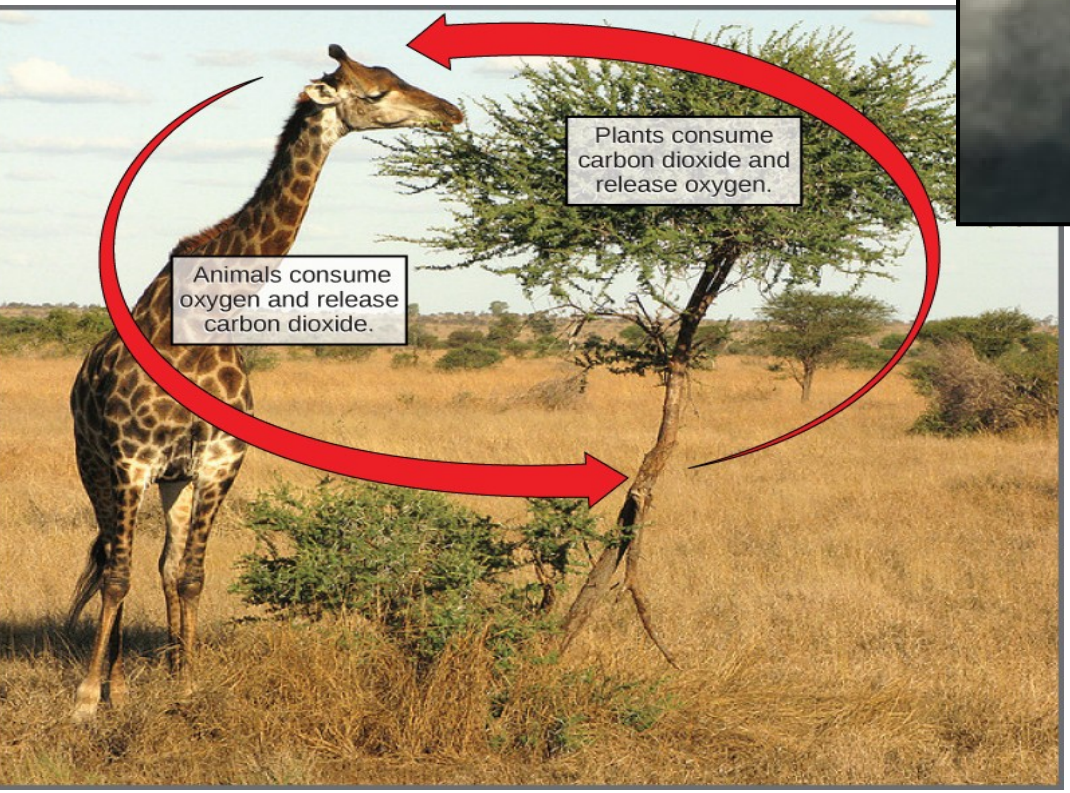
The carbon cycle is the movement of carbon from the nonliving environment into living things and back.

Carbon is the essential component of proteins, fats, and carbohydrates,

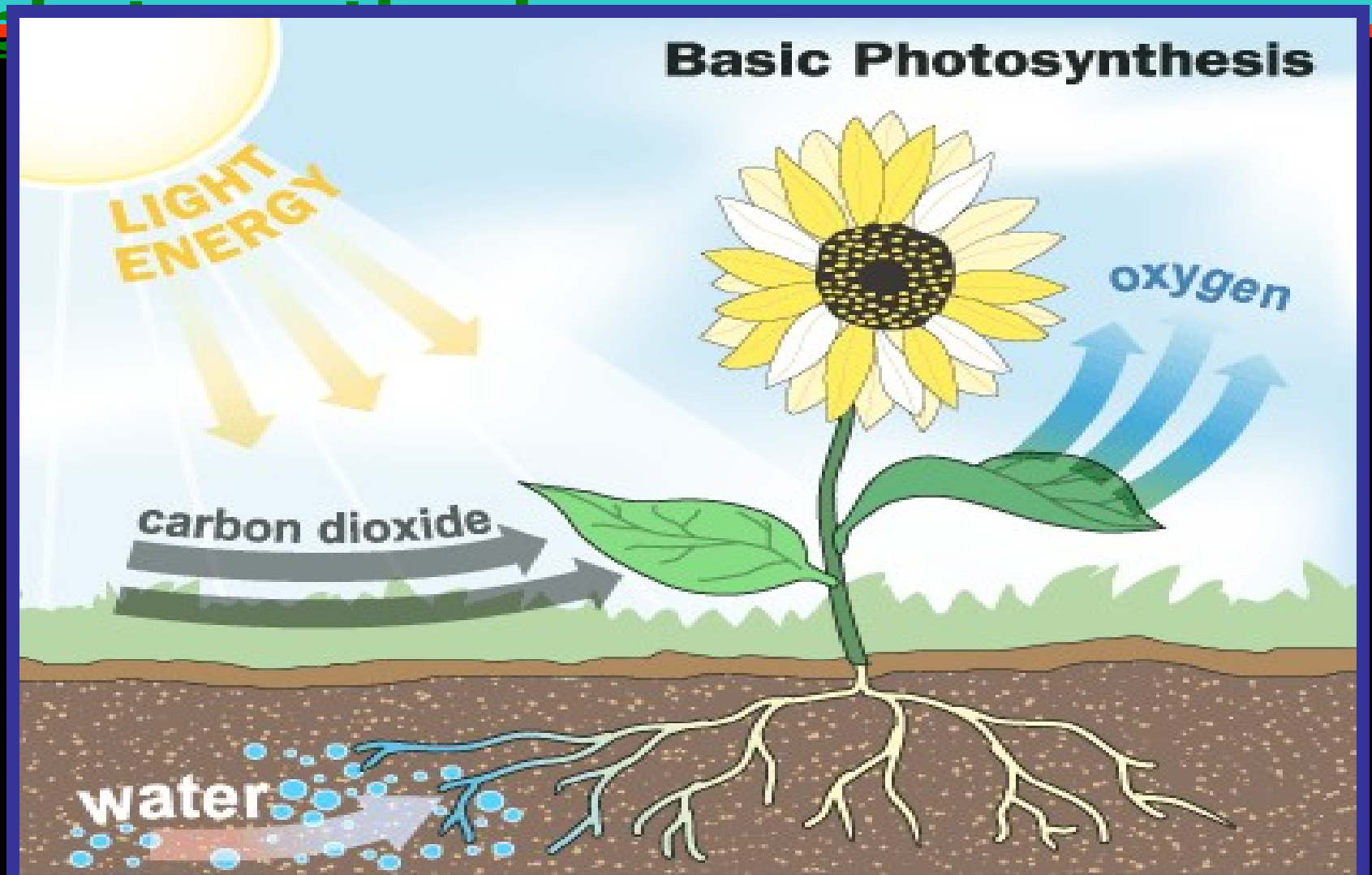
- **Carbon is a key ingredient of living tissue.**
- **In the atmosphere, carbon is present as carbon dioxide gas. CO_2**

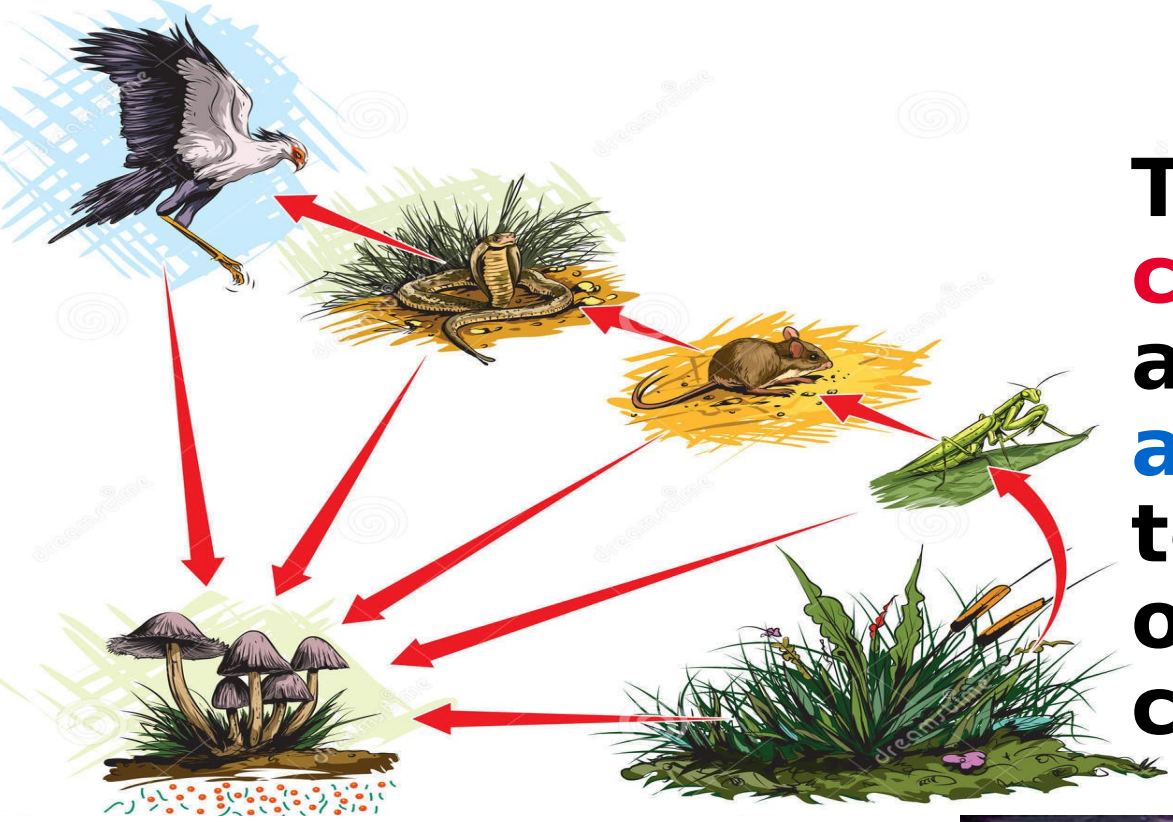
Carbon dioxide is released into the atmosphere by:

- volcanic activity
- respiration
- human activities
- the decomposition



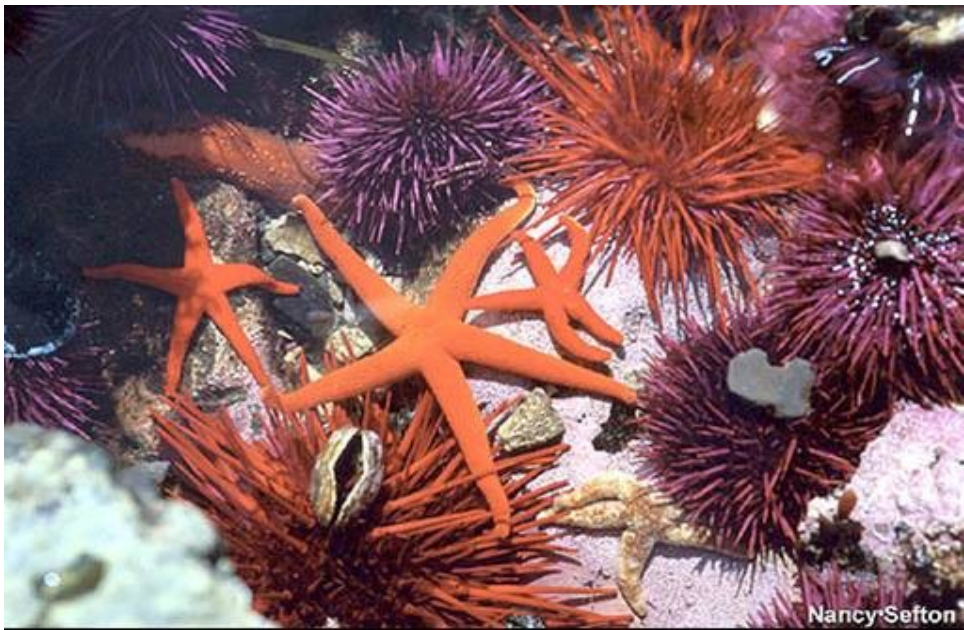
Plants take in carbon dioxide and use the carbon to build carbohydrates during p





The carbohydrates are passed along food webs to animals and other consumers.

In the ocean, carbon is also found in calcium carbonate which is formed by many marine organisms.



The Carbon Cycle cont…

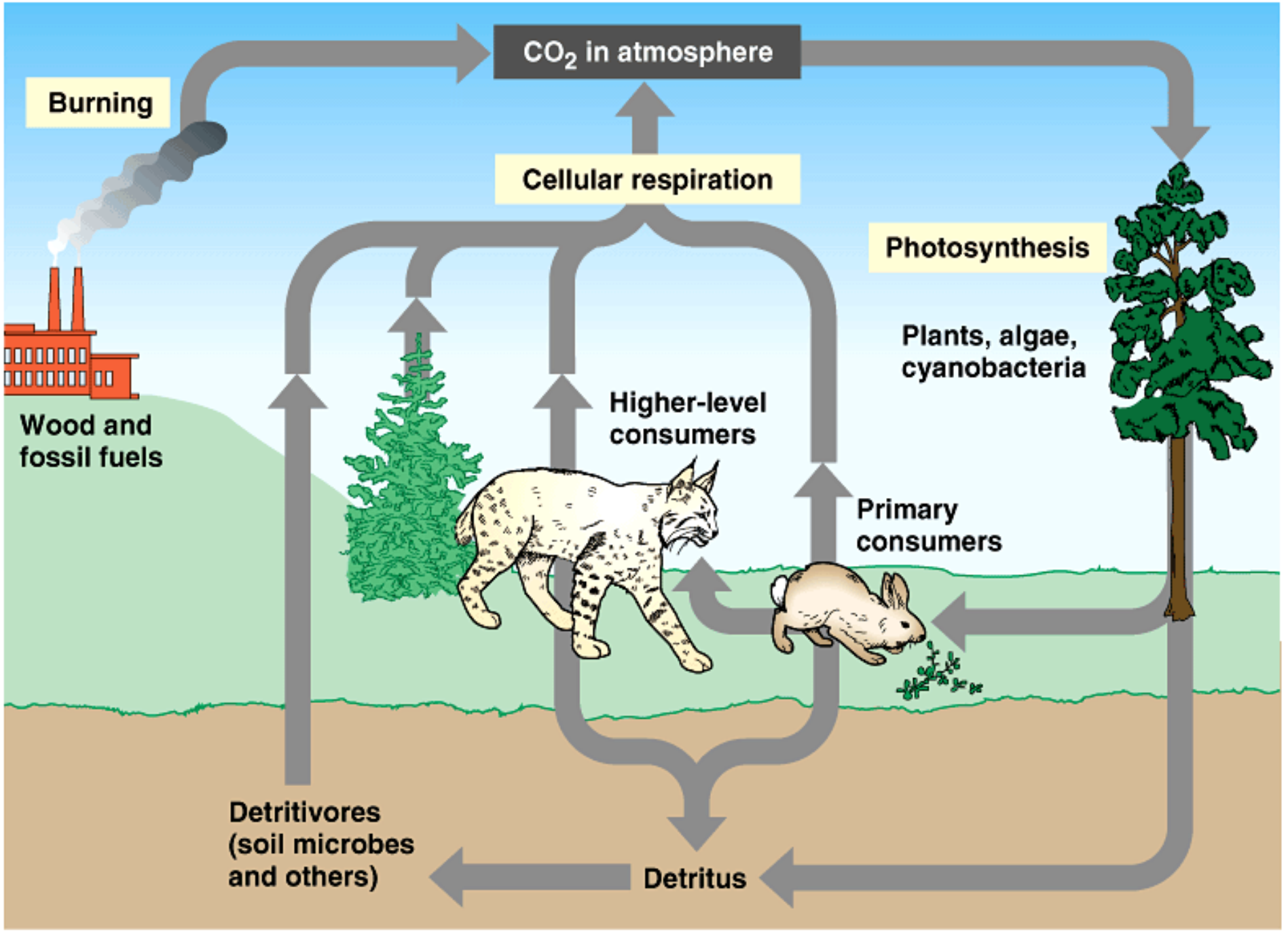
- **Carbon stored as fat, oils, or other molecules may be released into the soil or air when the organisms dies.**
- **These molecules fo deposits of coal, oi or natural gas, whi are known as fossil fuels.**
- **Fossil fuels store carbon.**

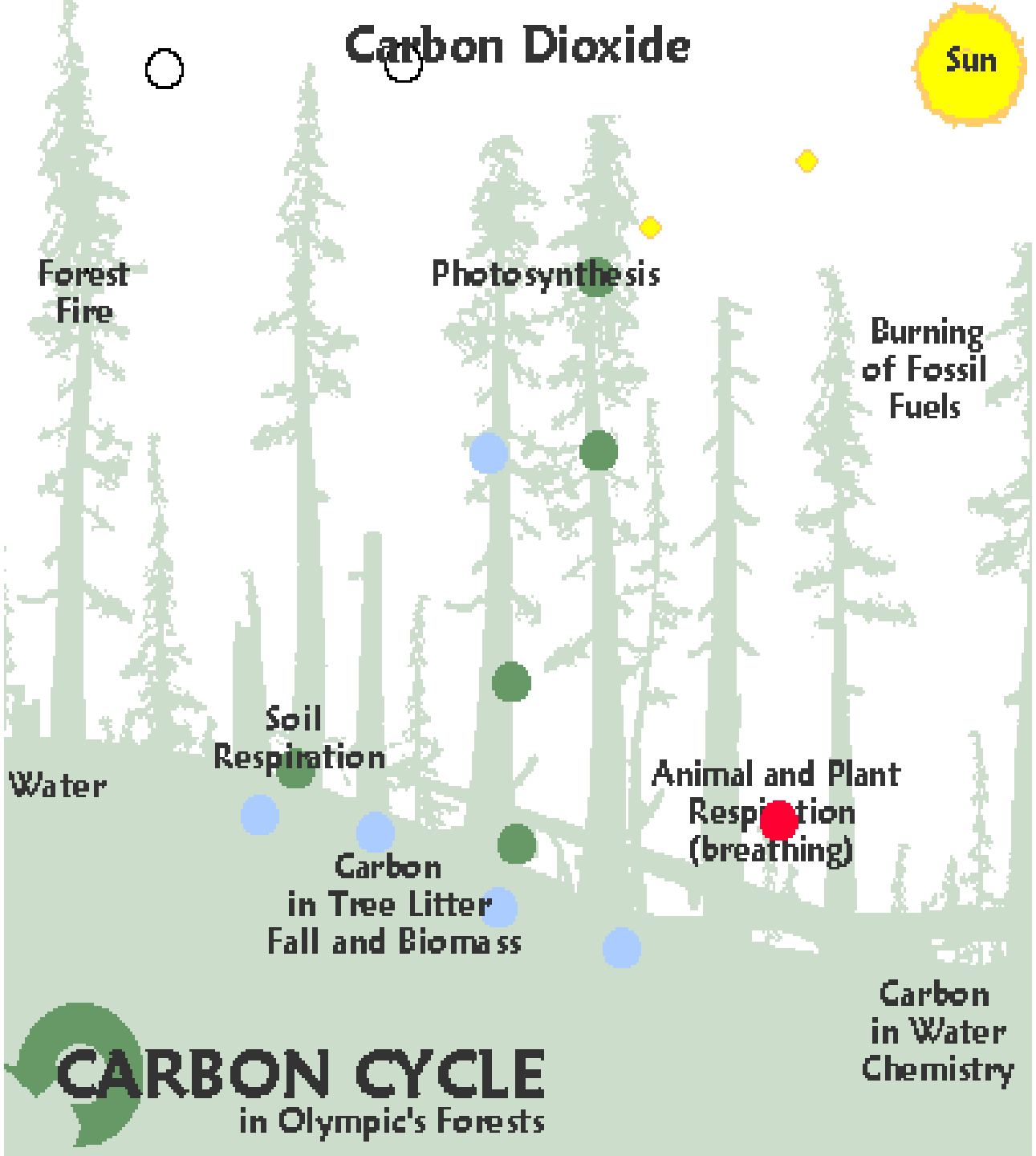
How Humans Affect the Carbon Cycle

- Humans burn fossil fuels releasing carbon into the atmosphere.
- The carbon returns to the atmosphere as carbon dioxide.

How Humans Affect the Carbon Cycle

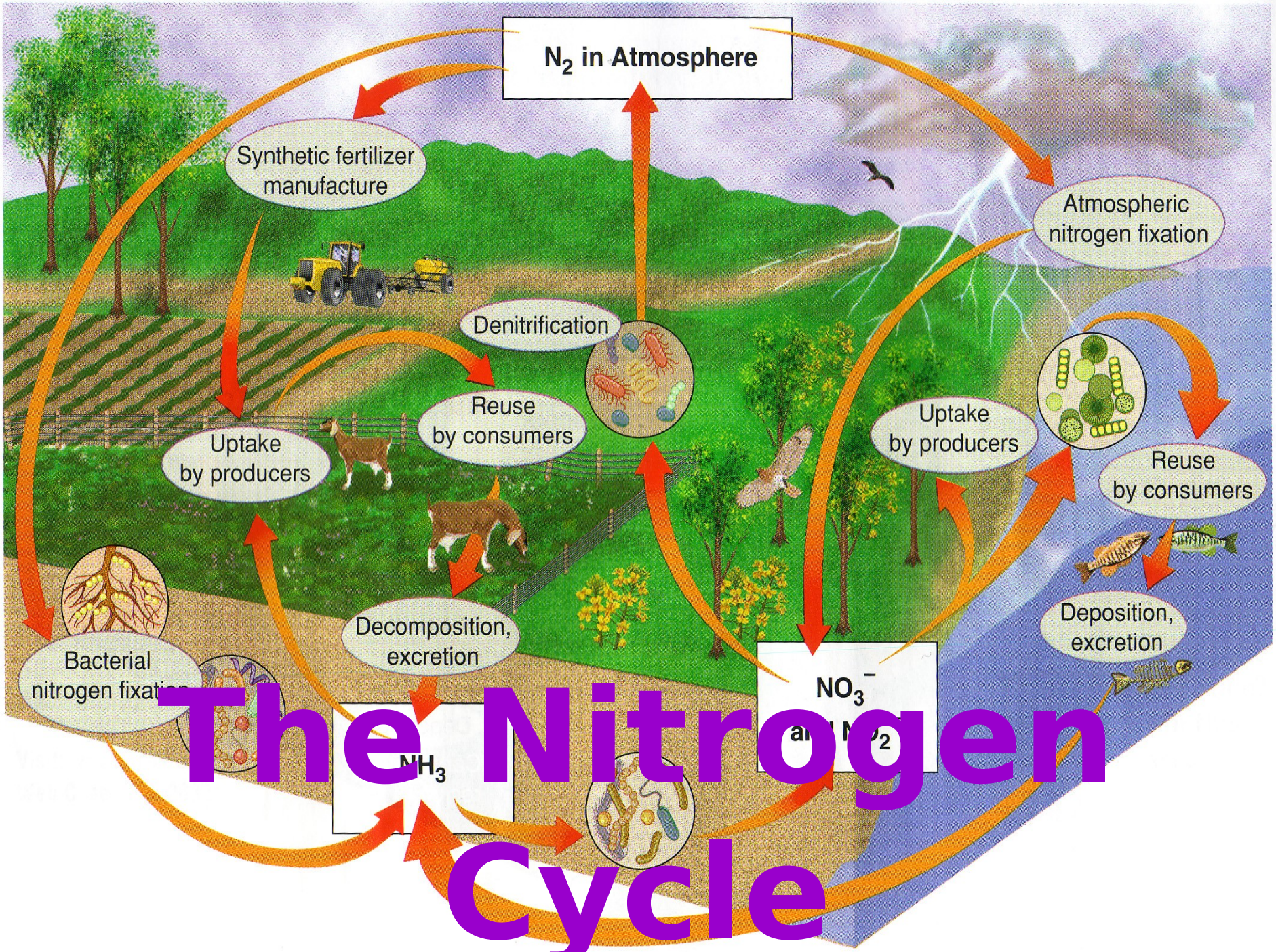
- **Increased levels of carbon dioxide may contribute to global warming**
- **Global warming is an increase in the temperature of the Earth.**




Carbon Dioxide
Sun
Forest Fire
Photosynthesis
Burning of Fossil Fuels
Soil Respiration
Water
Animal and Plant Respiration (breathing)
Carbon in Tree Litter Fall and Biomass
Carbon in Water Chemistry
CARBON CYCLE
in Olympic's Forests

Carbon Cycle Review

1. How do plants obtain carbon?
2. How do animals obtain carbon?
3. How does carbon recycle back through the hydrosphere, atmosphere, and lithosphere?
4. Describe the two processes of the carbon cycle.
5. Describe how the burning of fossil fuels affects the carbon cycle.
6. Describe the role of carbon dioxide in the carbon cycle.
7. What is one way that a person can help reduce the level of carbon dioxide in the atmosphere? Can you think of more than one way?

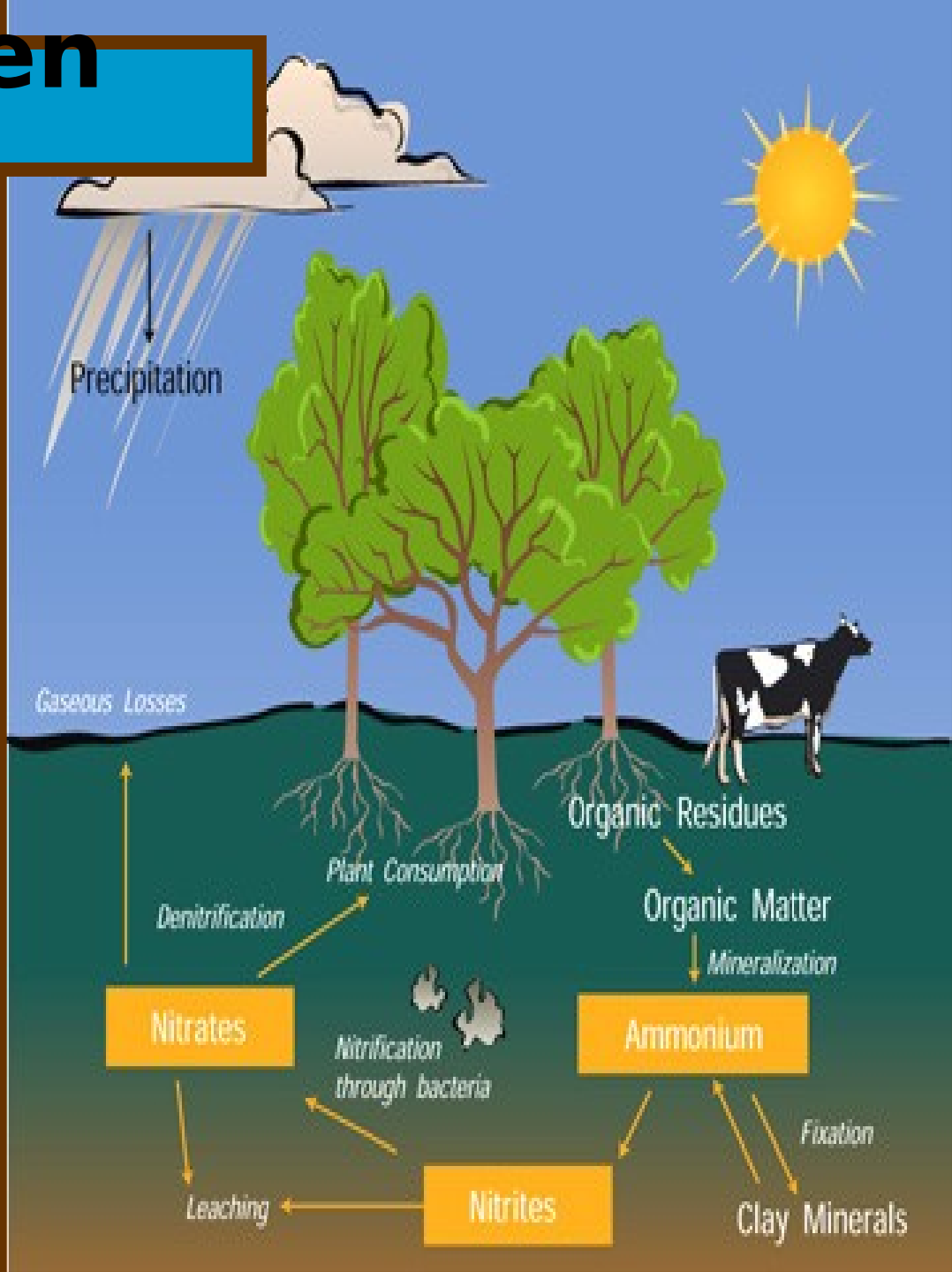

N_2 in Atmosphere
Synthetic fertilizer manufacture
Atmospheric nitrogen fixation
Denitrification
Reuse by consumers
Uptake by producers
Uptake by producers
Reuse by consumers
Decomposition, excretion
Deposition, excretion
Bacterial nitrogen fixation
NO_3^-
NH_3
The Nitrogen Cycle

The Nitrogen Cycle

The nitrogen cycle is the process in which nitrogen circulates among the air, soil, water, plants, and animals in an ecosystem.

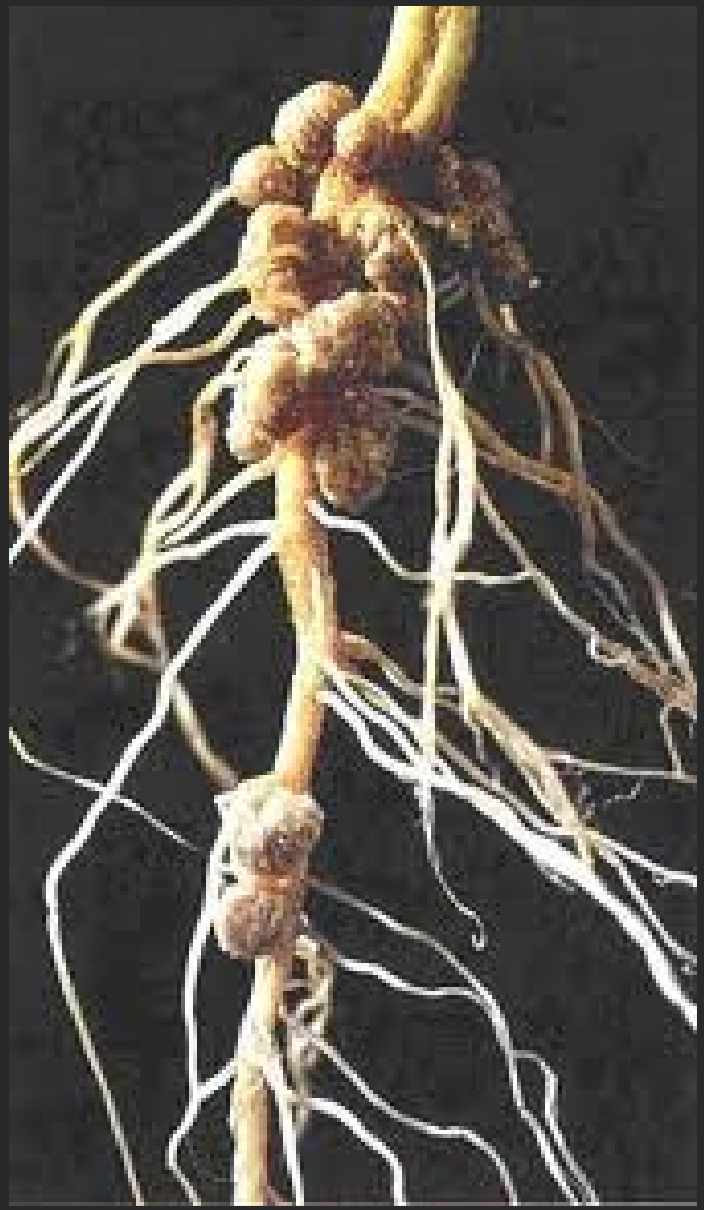
All organisms need nitrogen to build proteins.

Nitrogen makes up 78% of the gases in the atmosphere.



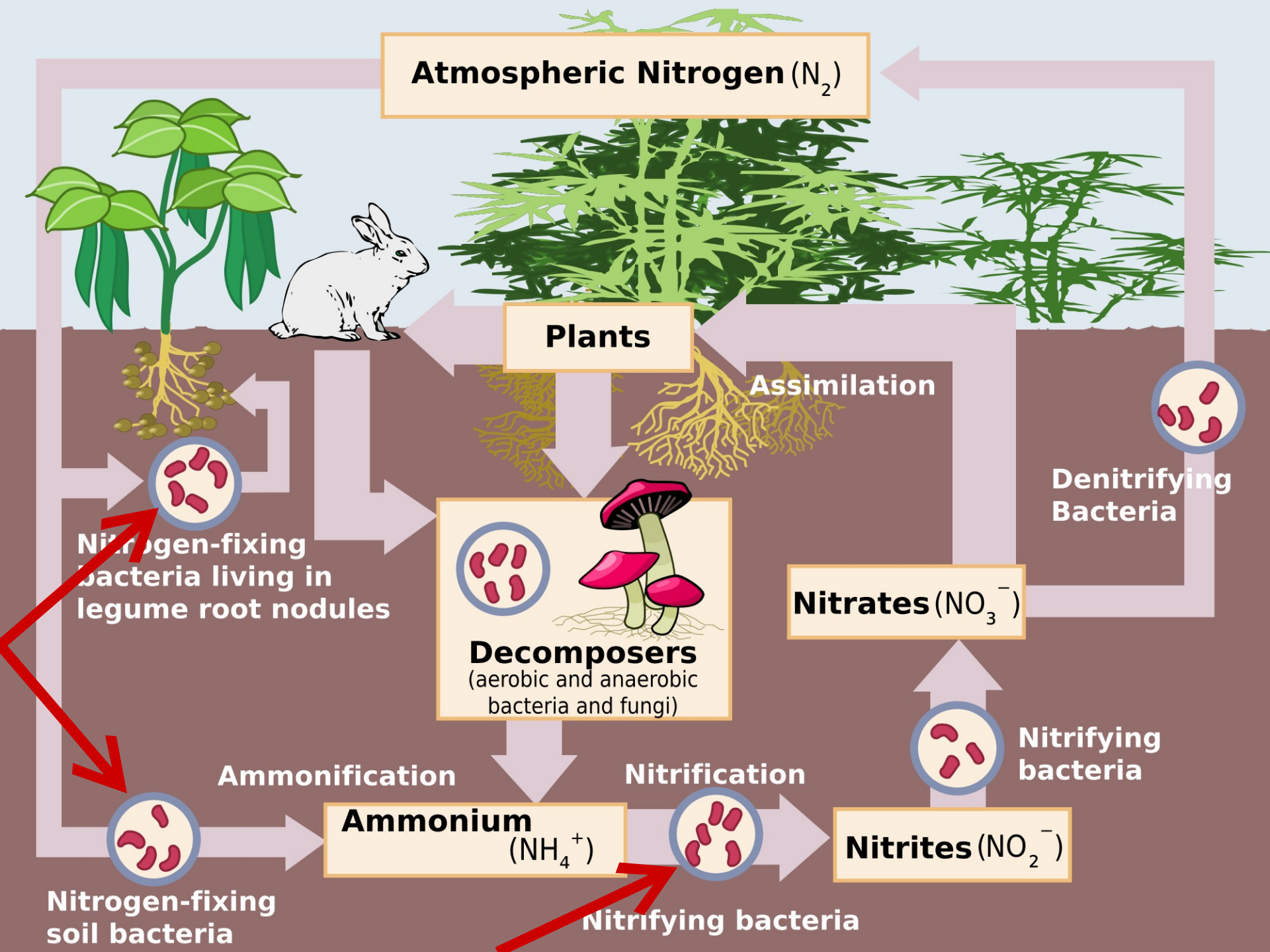
The Nitrogen Cycle

- **Nitrogen must be altered or fixed before organisms can use it.**
- **Nitrogen must be converted into compounds that can enter food webs by the process of Nitrogen Fixation.**
- **These bacteria are known as nitrogen-fixing bacteria.**



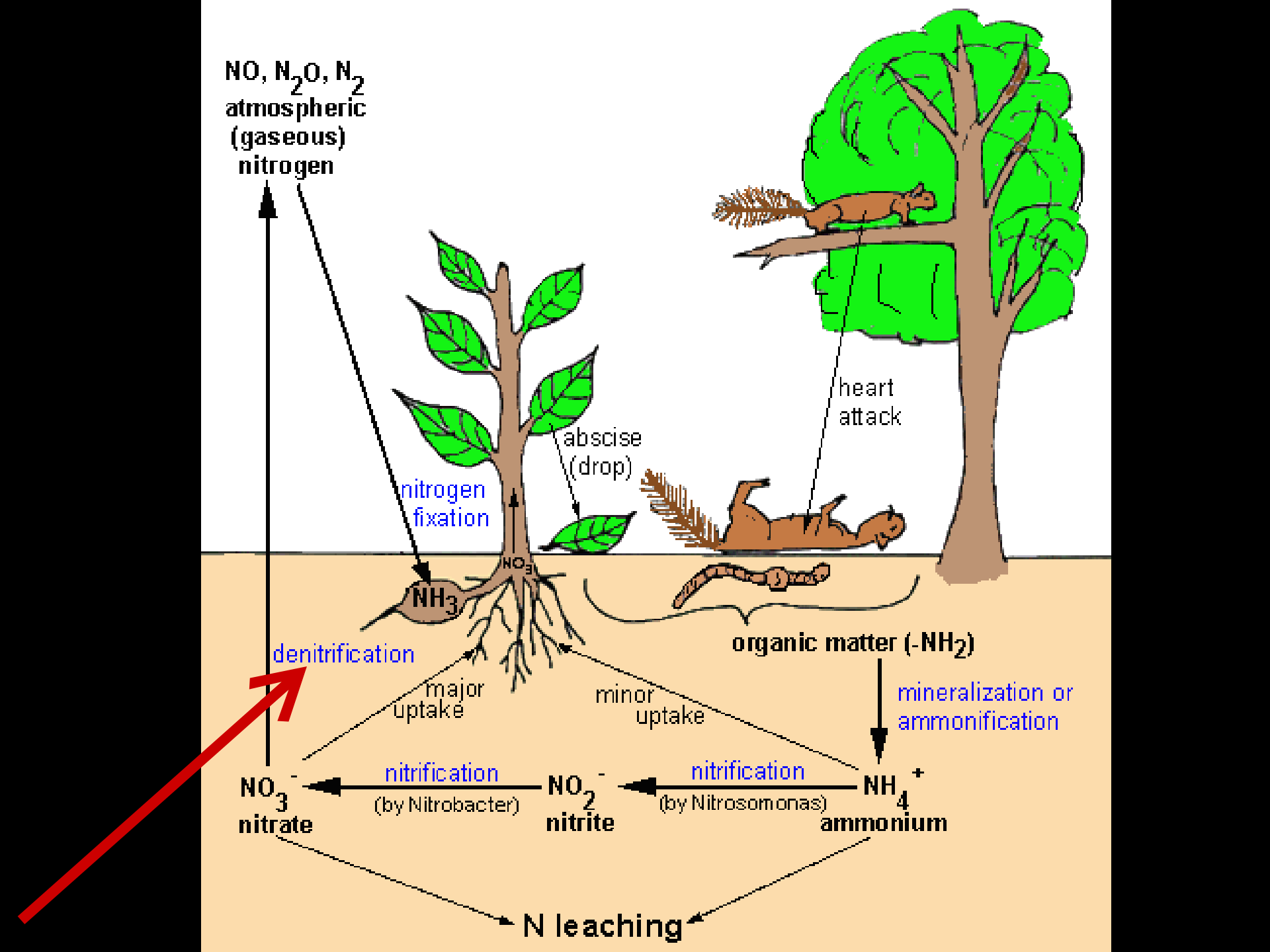
Nitrogen Fixation

- How do we get the Nitrogen we need? Nitrogen Fixation.
- Specialized bacteria convert N_2 from the atmosphere to ammonia (NH_3) for the plants to use.
- Plants will use to the ammonia to make nitrogen-containing organic molecules
  - Proteins, DNA, RNA
- Animals get nitrogen by eating plants or plant-eating animals


Atmospheric Nitrogen (N_2)
Plants
Assimilation
Denitrifying Bacteria
Nitrogen-fixing bacteria living in legume root nodules
Decomposers
(aerobic and anaerobic bacteria and fungi)
Nitrates (NO_3^-)
Nitrifying bacteria
Ammonification
Nitrification
Ammonium (NH_4^+)
Nitrites (NO_2^-)
Nitrogen-fixing soil bacteria
Nitrifying bacteria

Denitrification

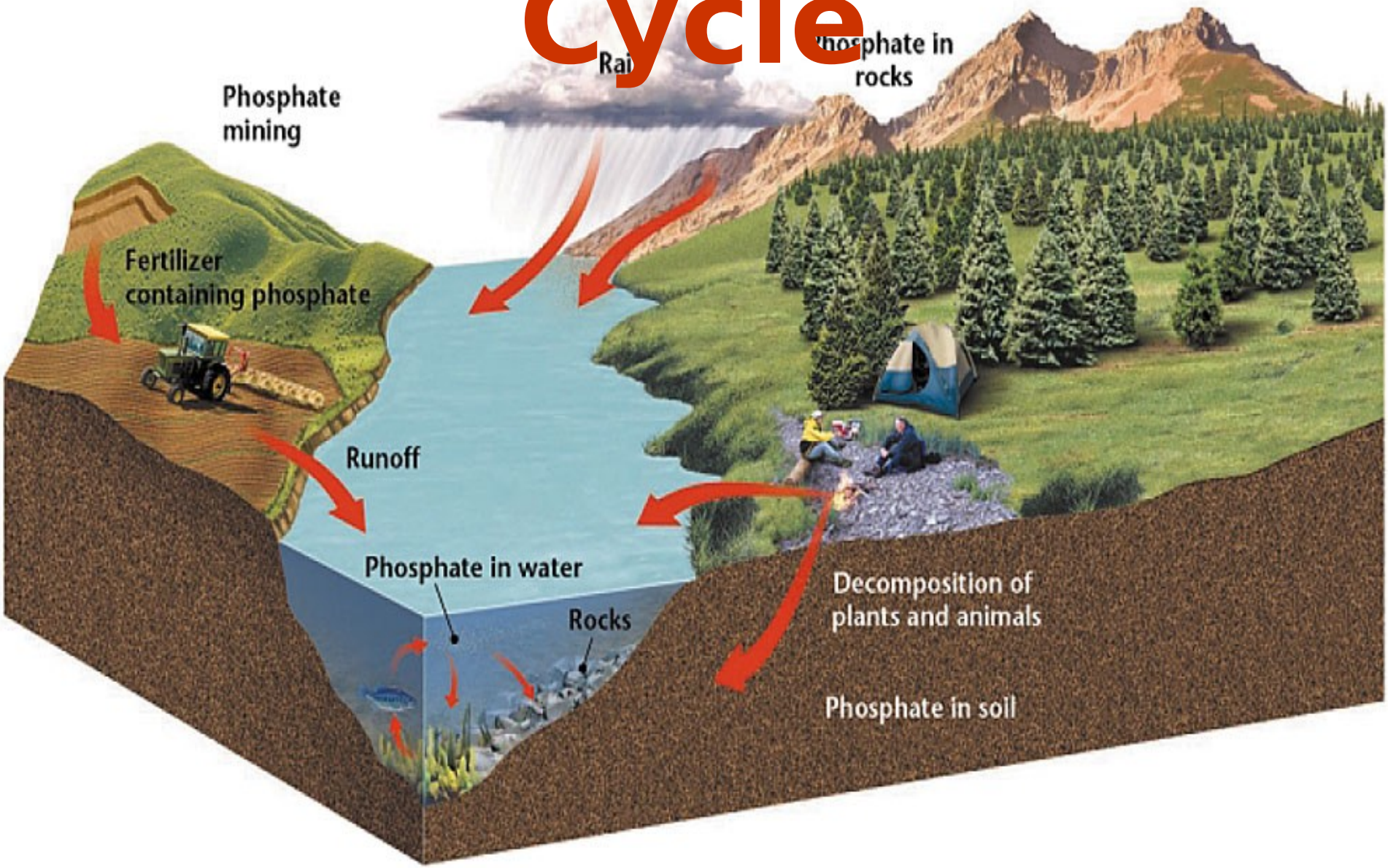
- How is nitrogen returned to the soil? Denitrification
- When organisms die, decomposers return nitrogen to the soil. Other bacteria change nitrogen compounds called nitrates (NO_3) back into nitrogen gas (N_2).
- This process is called denitrification.


NO, N_2O, N_2
atmospheric
(gaseous)
nitrogen
heart
attack
abscise
(drop)
nitrogen
fixation
NO_3
NH_3
denitrification
organic matter (-NH_2)
major
uptake
minor
uptake
mineralization or
ammonification
NO_3^-
nitrate
nitrification
(by Nitrobacter)
NO_2^-
nitrite
nitrification
(by Nitrosomonas)
NH_4^+
ammonium
N leaching

Nitrogen Cycle Review

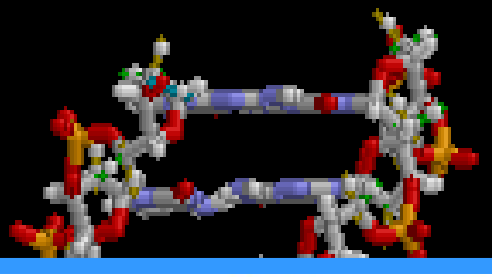
1. How do plants obtain nitroge
2. How do animals obtain nitro
3. How does it recycle back through the hydrosphere, atmosphere, and lithosphere?
4. What is the role of nitrogen-fixing bacteria in the nitrogen cycle?
5. Which of the following statements about the nitrogen cycle is *not* true?
   - A. Animals get nitrogen by eating plants or other animals.
   - B. Plants generate nitrogen in their roots.
   - C. Nitrogen moves back and forth between the atmosphere and living things.
   - D. Decomposers break down waste to yield ammonia.
6. Abandoned fields in the southwestern part of the United States are often taken over by mesquite trees, which can grow in nutrient-poor soil. If the land is later cleared of

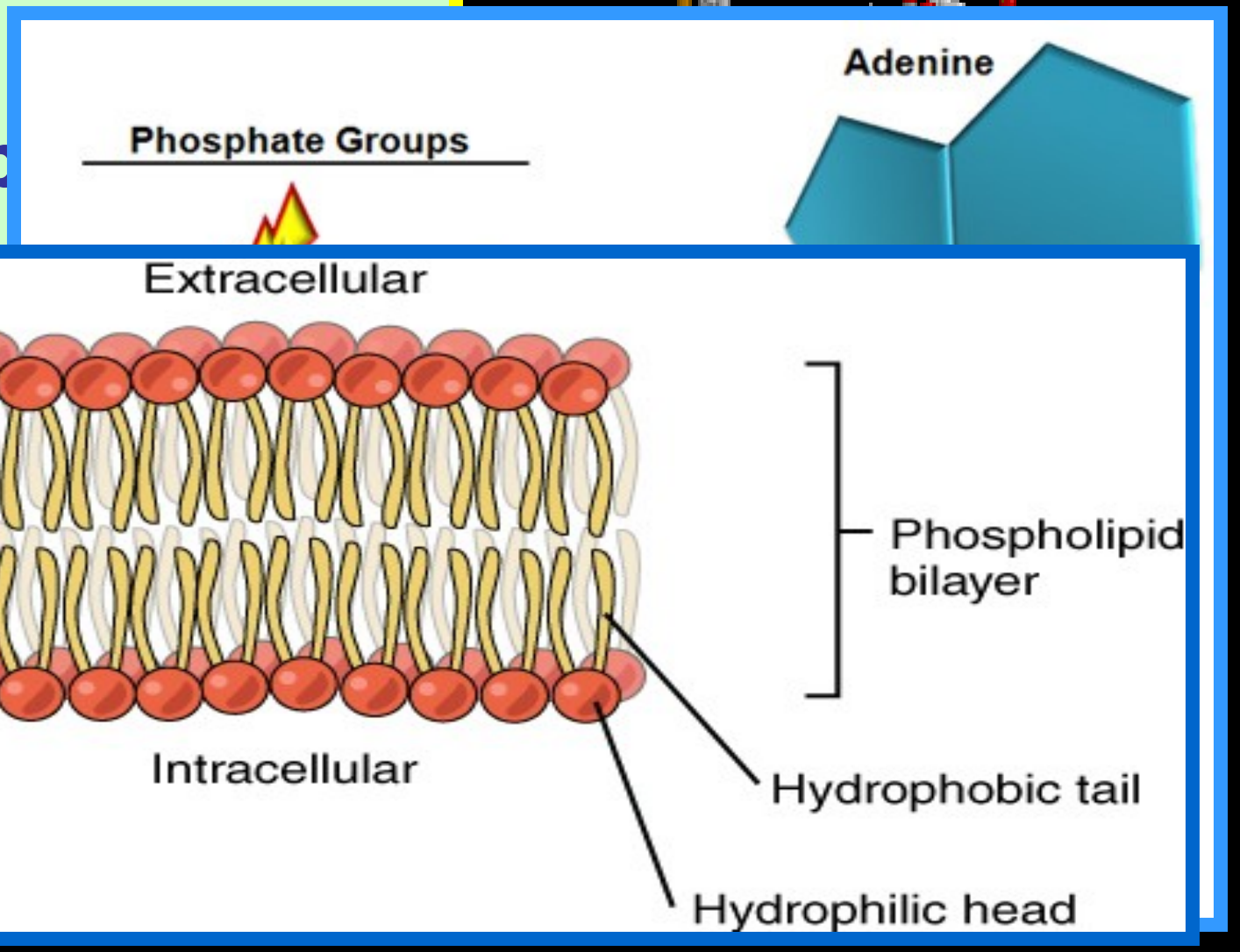
The Phosphorus Cycle



- **Phosphorus is necessary for nucleic acids, fats, cell membranes, bones, teeth and shells.**
- **There is very little phosphorus in the atmosphere. Most phosphorus is stored in rocks and ocean sediments.**
- **This phosphorus is *slowly* released into water and soil and then used by organisms.**

- **Phosphorus** is a key part of:
  - ATP
  - Phosp
  - DNA



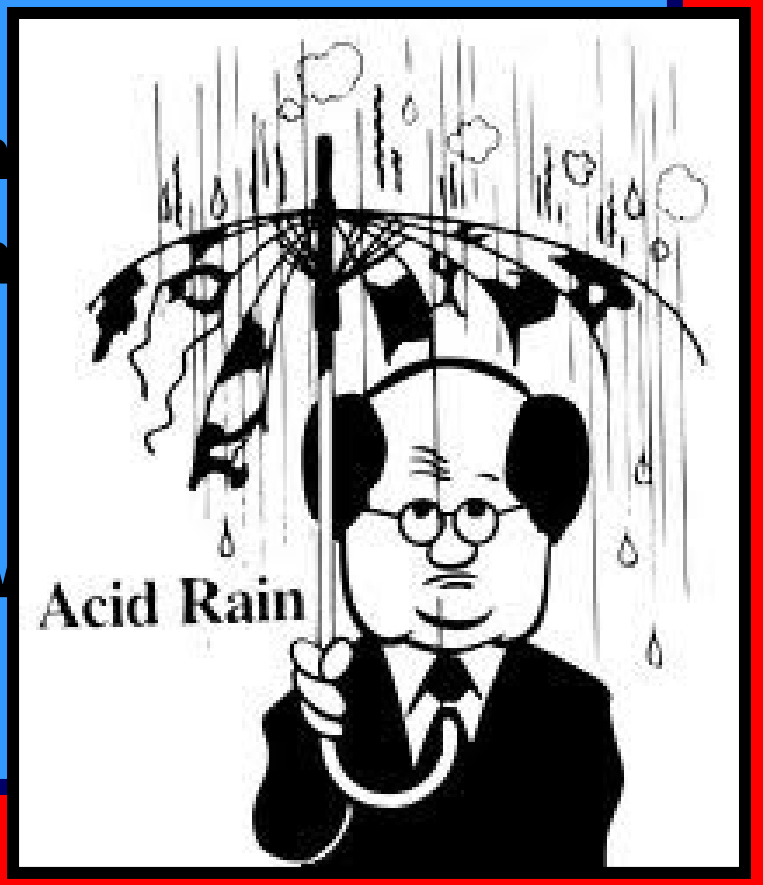


Fertilizers and the Nitrogen and Phosphorus Cycles

- **Fertilizers contain both nitrogen and phosphorus.**
- **Excessive amounts of fertilizer can enter terrestrial and aquatic ecosy runoff.**
- **Excess nitrogen and phosph can cause rapid growth of al - algal bloom.**
- **Excess algae can deplete an aquatic ecosystem of import nutrients such as oxygen, or which fish and other aquatic**

Acid Precipitation

- When fuel is burned, large amounts of **nitric oxide** is release into the atmosphere.
- In the air, nitric oxide ca
  combine with oxygen an
  water vapor to form **nitric acid**.
- Dissolved in rain or snov
  the nitric acid falls as **acid precipitation**.



Review

1. How do plants obtain phosphoru
2. How do animals obtain phospho
3. How does it recycle back through the hydrosphere, atmosphere, and lithosphere?
4. Explain how the excess use of fertilizer affects the nitrogen cycle and the phosphorus cycle.
5. Explain why the phosphorus cycle occurs more slowly than both the carbon cycle and the nitrogen cycle.
6. Write a short paragraph that describes the importance of bacteria in the carbon, nitrogen, and phosphorus cycles. What role does bacteria play in each cycle?
7. Excessive use of fertilizer that contains nitrogen and phosphorus
   A. affects the carbon cycle.
   B. may cause algal blooms in waterways.
   C. causes soil erosion.
   D. contributes to primary succession.
8. Describe the importance of the carbon